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Aerodynamics (2)
Stability and Control (1)
Airplanes,- Control characteristics (08395); Airplanes - Stability (08487); Airplanes, Bomber - Performance charts (08517)

MR 1@L26

Charts showing stability and control characteristics of airplanes in flight

National Advisory Committee for Aeronautics, Washington, D. C.

U.S. Eng. Unclass. Dec '44 32 graphs

A collection of charts is presented which indicates the satisfactory and unsatisfactory stability and control characteristics of fighters, Navy scout and patrol bombers and of trainees. Elevator, aileron and rudder control characteristics and dihedral characteristics are also evaluated. These charts were used during a conference to portray good and undesirable airplane flight characteristics.

NOTE: Requests for copies of this report must be addressed to: N.A.C.A., Washington, D. C.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

WARTIME REPORT

ORIGINALLY ISSUED
December 1944 as
Memorandum Report L4L26

CHARTS SHOWING STABILITY AND CONTROL CHARACTERISTICS OF AIRPLANES IN FLIGHT

By Stability and Control Section
of Flight Research Division

Langley Memorial Aeronautical Laboratory
Langley Field, Va.

NACA

WASHINGTON

MR No. L4L26

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

MEMORANDUM REPORT

for the

Army Air Forces, Air Technical Service Command

and the

Bureau of Aeronautics, Navy Department

CHARTS SHOWING STABILITY AND CONTROL CHARACTERISTICS OF AIRPLANES IN FLIGHT

By Stability and Control Section
of Flight Research Division

INTRODUCTION

During October 1944, the National Advisory Committee conducted a series of conferences with the Army, Navy, and representatives of the aircraft industry for the purpose of discussing the flight-test procedures used in measuring the stability and control characteristics of airplanes. The conferences were initiated by the Army Air Forces, Air Technical Service Command, to acquaint the flight organizations of the industry with the flight test methods employed by the NACA and to standardize the techniques insofar as possible as they are employed by the various manufacturers and agencies engaged in determining the flying qualities of airplanes.

To facilitate the discussion during the conferences a series of charts was presented which portrayed typical good and undesirable airplane characteristics as determined in flight. The discussion centered around the characteristics portrayed and their relation to the Army Air Forces specifications for the stability and control of airplanes (reference 1). In general the following points were covered in connection with each chart:

(a) The purpose of the test

(b) The flight technique used

(c) Items recorded

(d) Evaluation and interpretation of data obtained

There were many requests from the conferees for copies of the charts presented for their further study and for reference with their notes taken during the discussion. Accordingly, the charts have been reproduced and are presented herein.

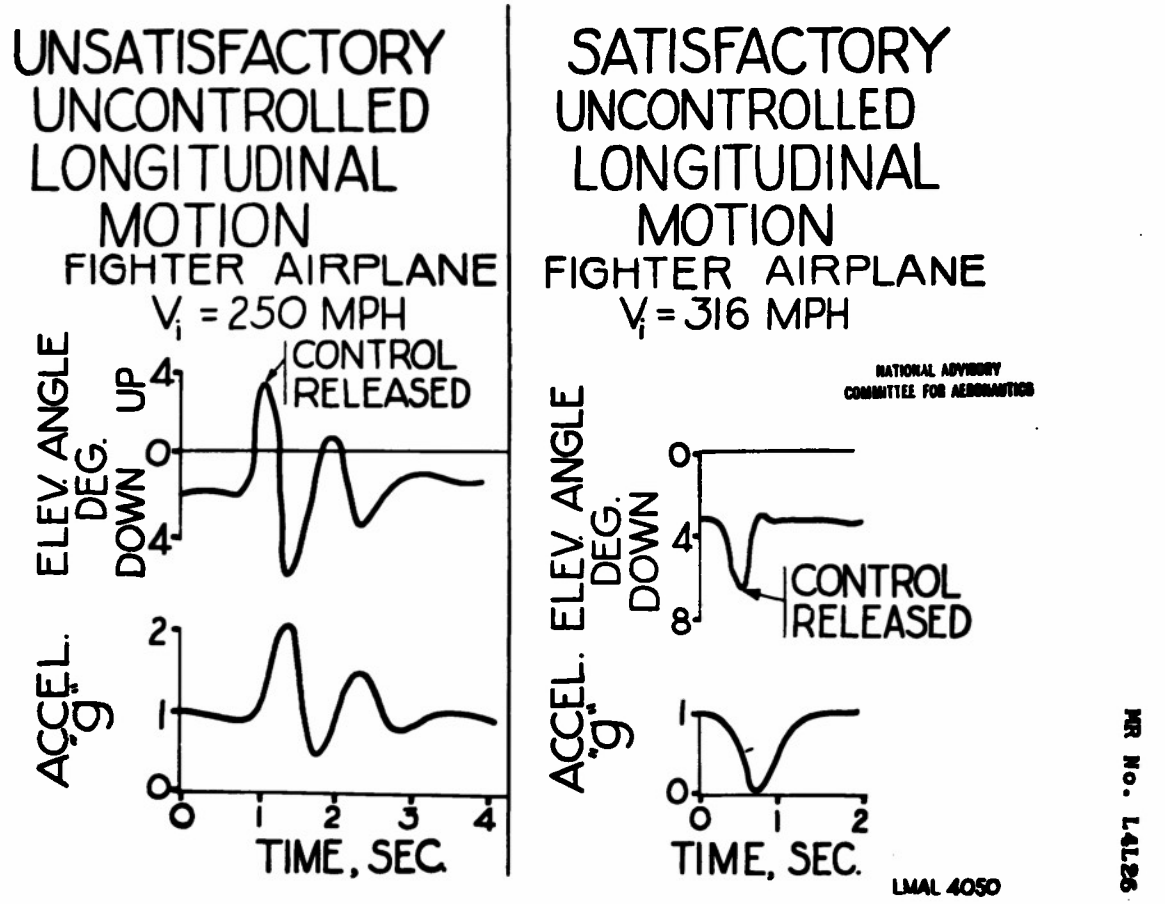
During the discussion there were many additional explanatory figures drawn on the blackboard so that the more formal charts do not give a complete picture of the material presented and discussed.

The conferences were held at both the Langley and Ames Laboratories of the NACA and a separate series of charts was presented by each group. Because of the similarity of the charts, however, only the charts presented at the Langley conference are given herein.

Langley Memorial Aeronautical Laboratory,
National Advisory Committee for Aeronautics,
Langley Field, Va., December 26, 1944.

REFERENCE

1. Anon.: Stability and Control Requirements for Airplanes. AAF Specification No. C-1815, Aug. 31, 1943.



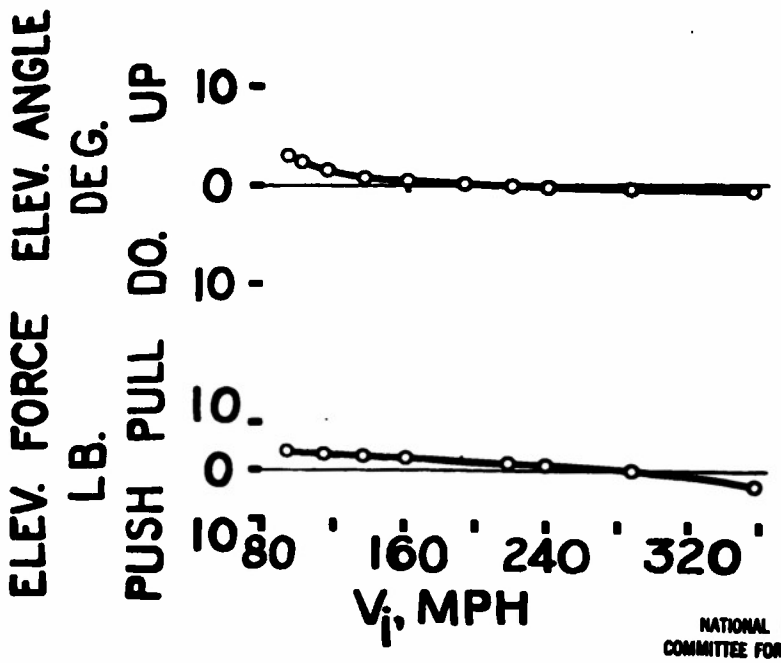
NR No. L4L26

Figure 1.

L-706

SATISFACTORY STICK FIXED AND STICK FREE STATIC LONGITUDINAL STABILITY

FIGHTER AIRPLANE
CLIMBING CONDITION



NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
LMAL 4055.

Figure 2.

UNSATISFACTORY STICK FREE LONGITUDINAL STABILITY

FIGHTER AIRPLANE

GLIDING CONDITION

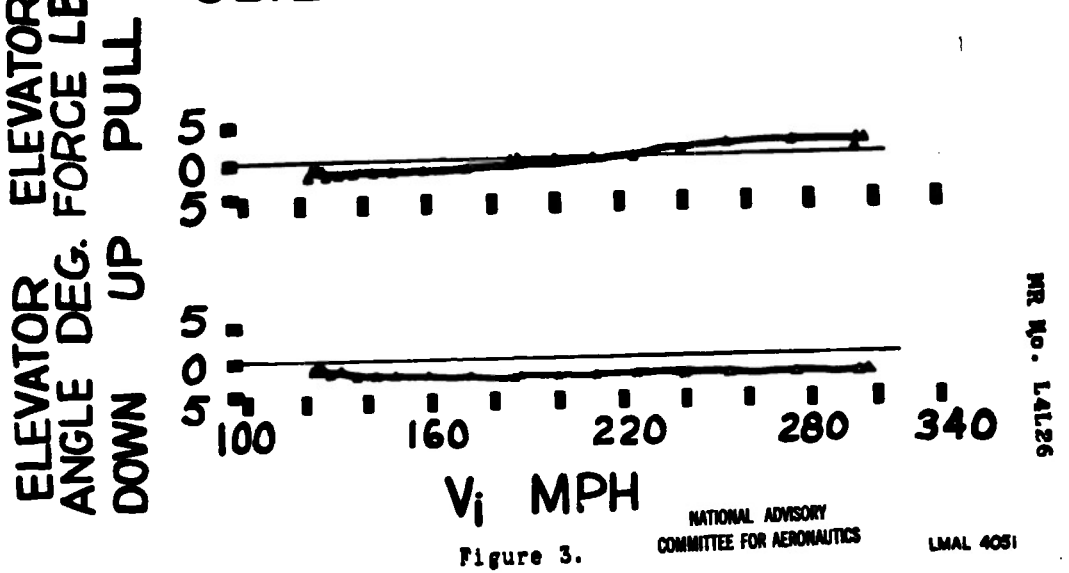


Figure 3.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

LMAL 4051

UNSATISFACTORY STICK FREE LONGITUDINAL STABILITY

L-706

FIGHTER AIRPLANE
CLIMBING CONDITION
RATED POWER, CLEAN

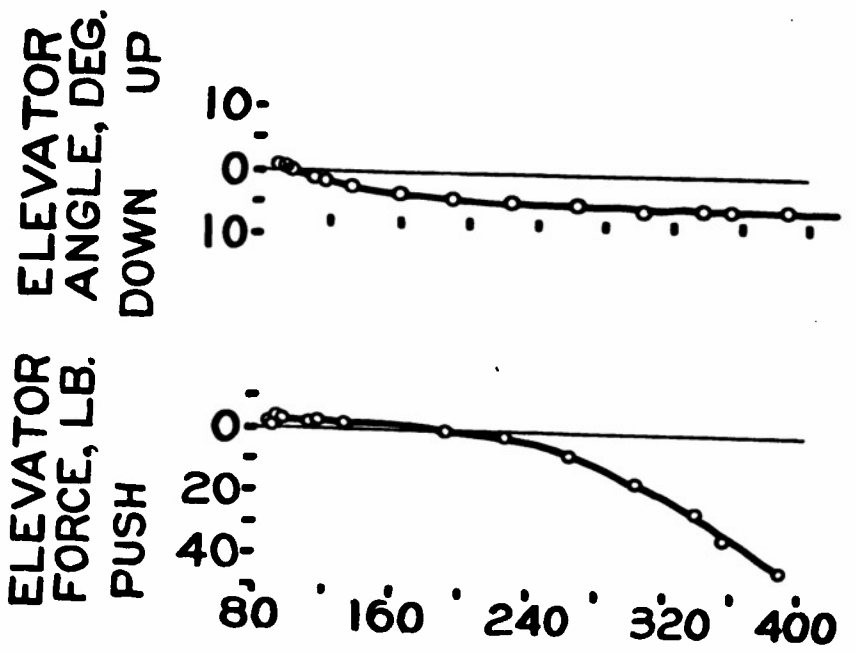


Figure 4. NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS LMAL 4052

MR No. L4L26

UNSATISFACTORY STICK FREE LONGITUDINAL STABILITY

FIGHTER AIRPLANE

CLEAN CONDITION, POWER ON

C.G. POSITION IN % M.A.C.

○ 22.85%

□ 27.3 %

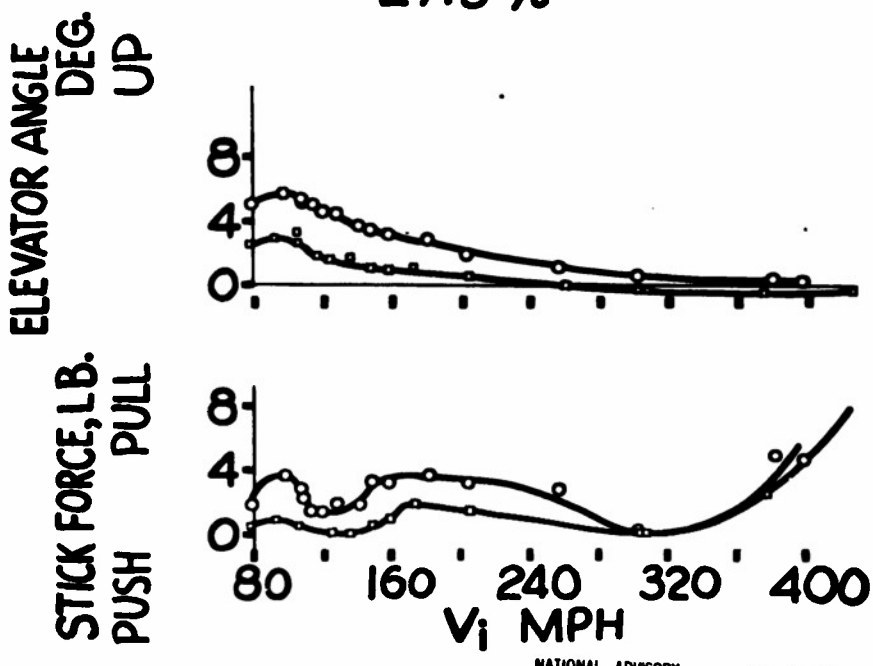


Figure 5.

UNSATISFACTORY STICK-FIXED LONGITUDINAL STABILITY

NAVY SCOUT BOMBER
CLIMBING CONDITION

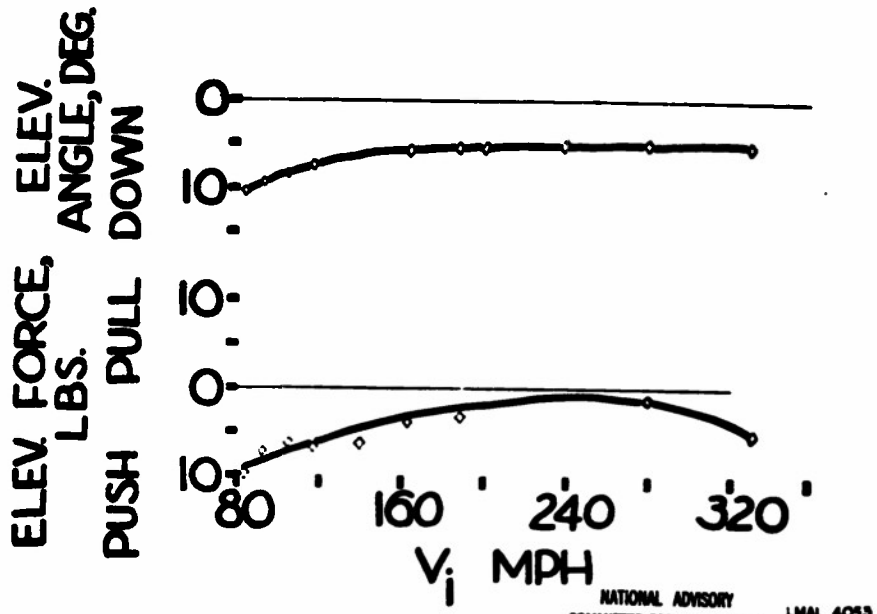


Figure 6.

MR No. L4L26

SATISFACTORY ELEVATOR FORCE CHARACTERISTICS IN ACCELERATED FLIGHT

FIGHTER AIRPLANE CRUISING CONDITION

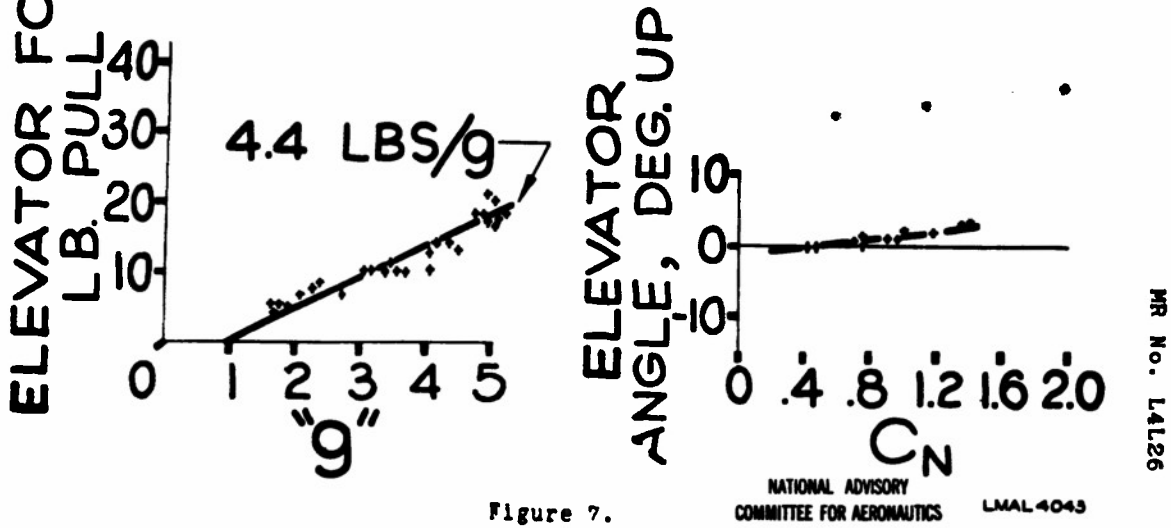


Figure 7.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

LMAL 4043

NR No. L4126

UNSATISFACTORY STICK FORCE CHARACTERISTICS IN ACCELERATED FLIGHT

NAVY SCOUT BOMBER WITH EXP. BALANCE TAB
V_i=170 MPH

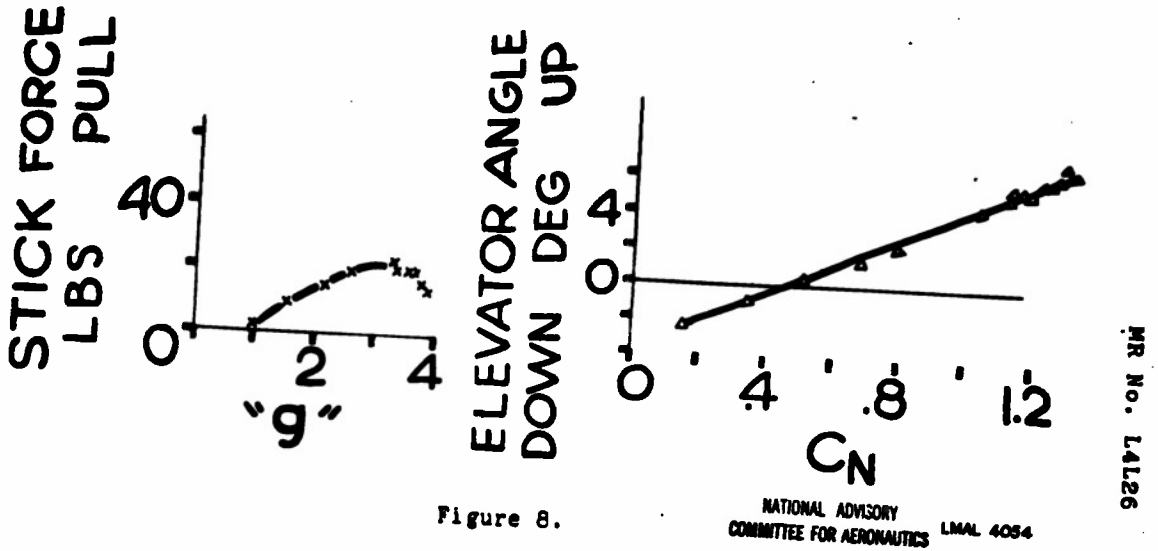


Figure 8.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS LMAL 4054

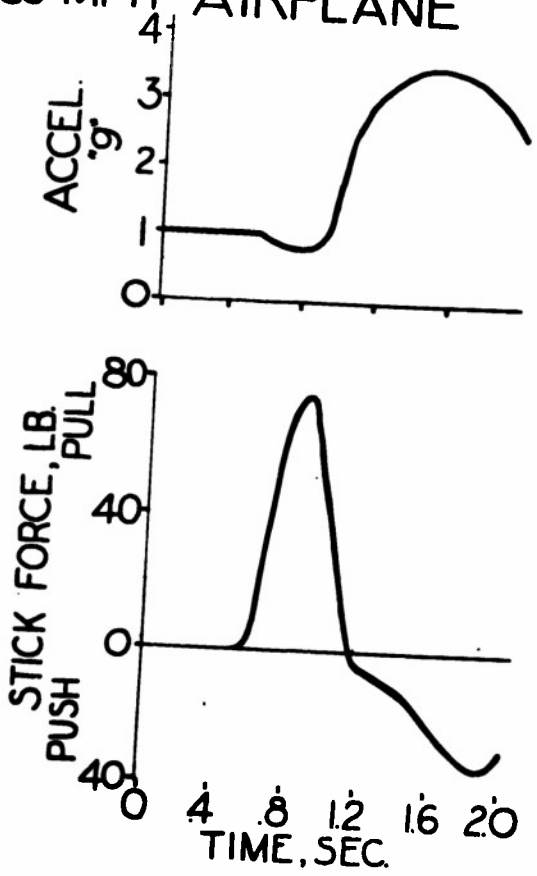
NR No. L4L26

L-706

MR No. L4L26

SATISFACTORY ELEVATOR CONTROL IN ABRUPT PULL-UPS-FIGHTER AIRPLANE

V_i = 188 MPH



NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

LMAL 4044

Figure 9.

L-706

UNSATISFACTORY ELEVATOR CONTROL - FIGHTER
IN ABRUPT P
V_i = 205 MPH AIR

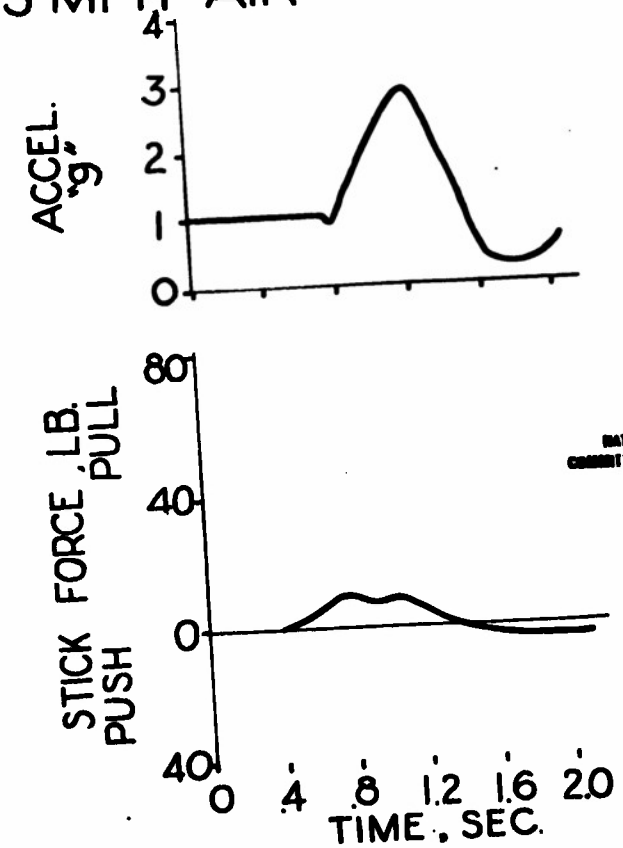


Figure 10.

LMAL 4045

L-706

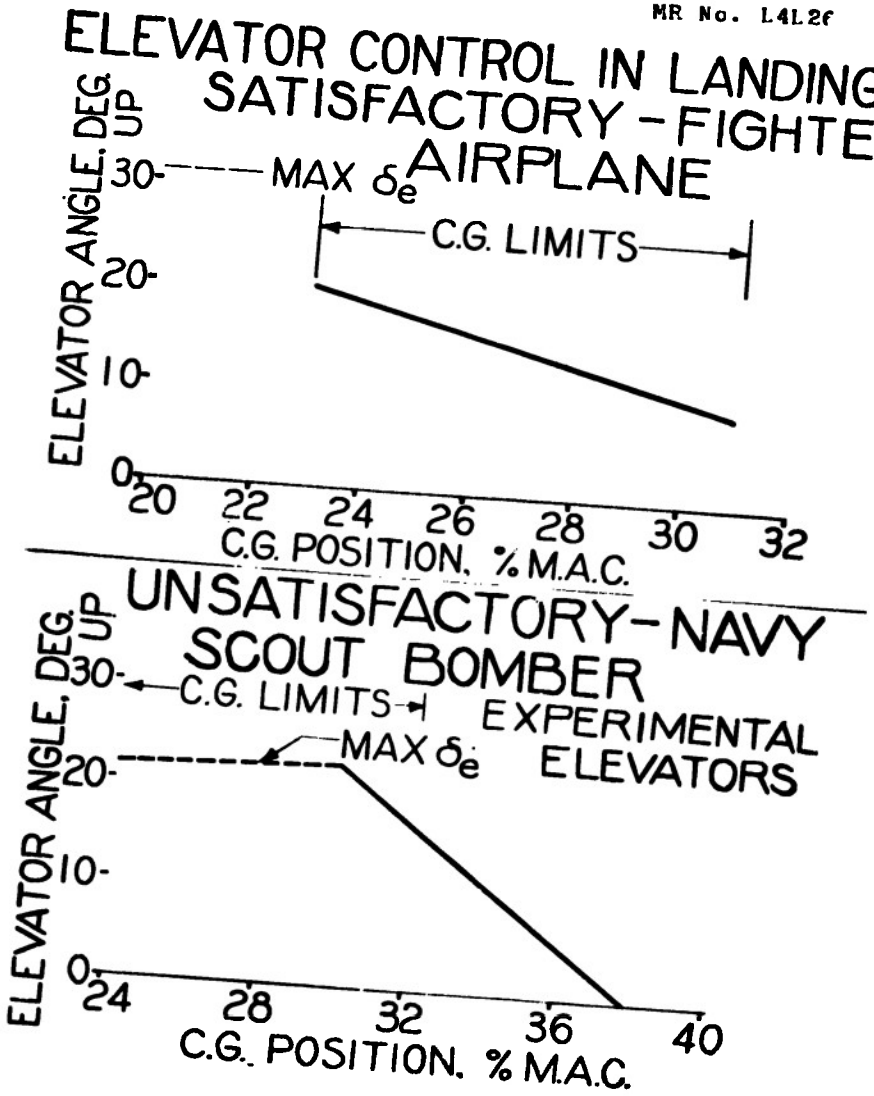


Figure 11.

CHANGE IN ELEVATOR FORCE FROM CLIMBING CONDITION AT V_i = 120 MPH

CONDITION	FIGHTER AIRPLANE	NAVY SCOUT BOMBER
CLIMBING	0	0
GLIDING	.4 PULL	14 PULL
LANDING	5.1 "	14 "
WAVE-OFF	2.9 "	3.5 "
APPROACH	5.4 "	10.7 "

Figure 12.

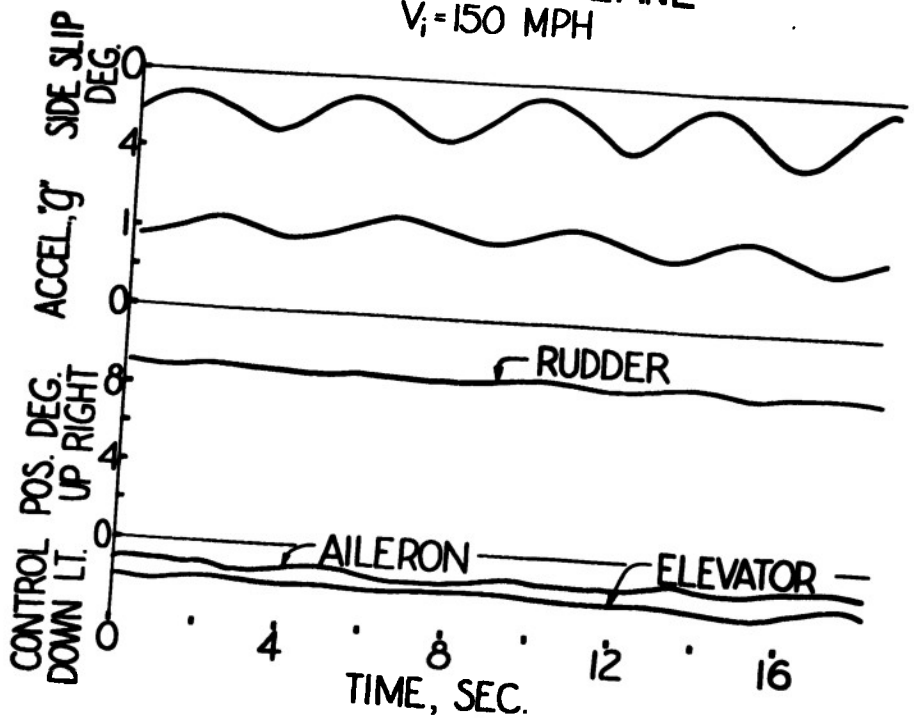
NR. No. L4126

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

LMAL 4041

UNSATISFACTORY CONTROL FIXED OSCILLATION

FIGHTER AIRPLANE
V_i = 150 MPH



NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

LMAL 4047

Figure 13.

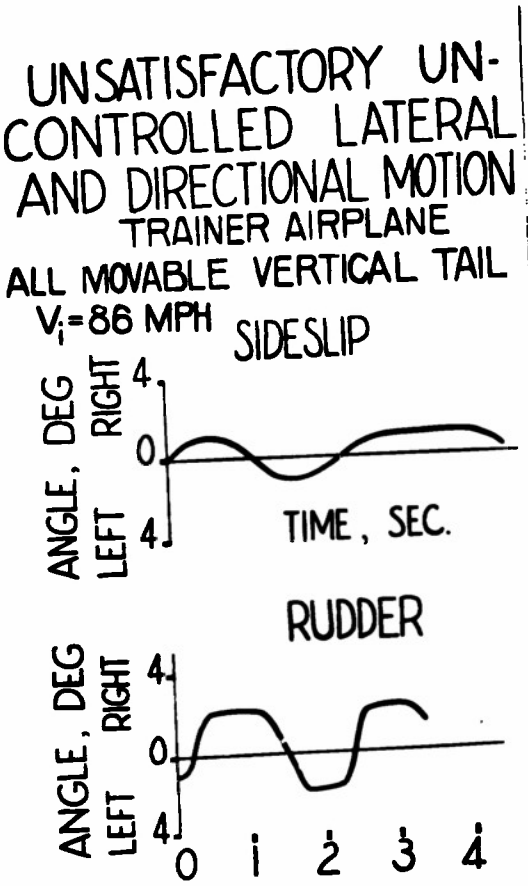


Figure 14.

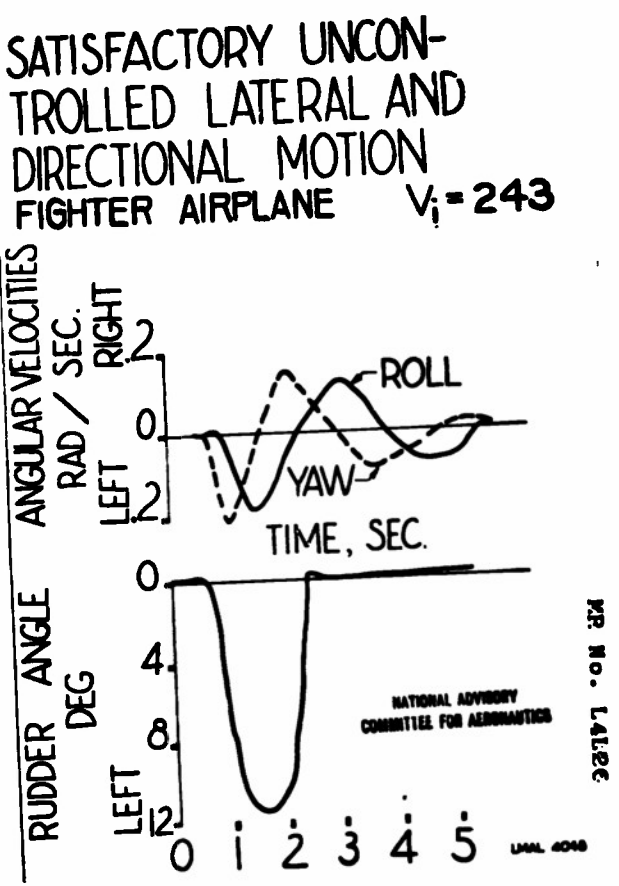


Figure 15.

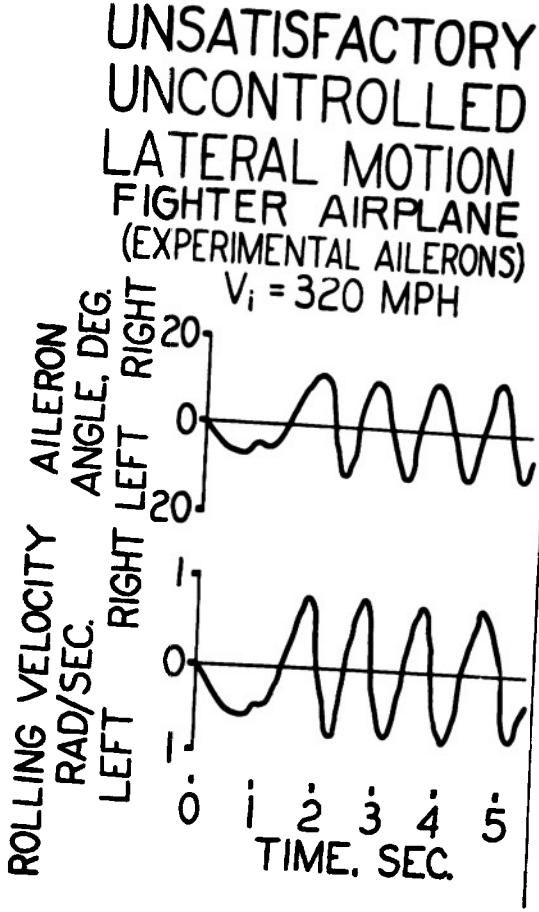


Figure 16.

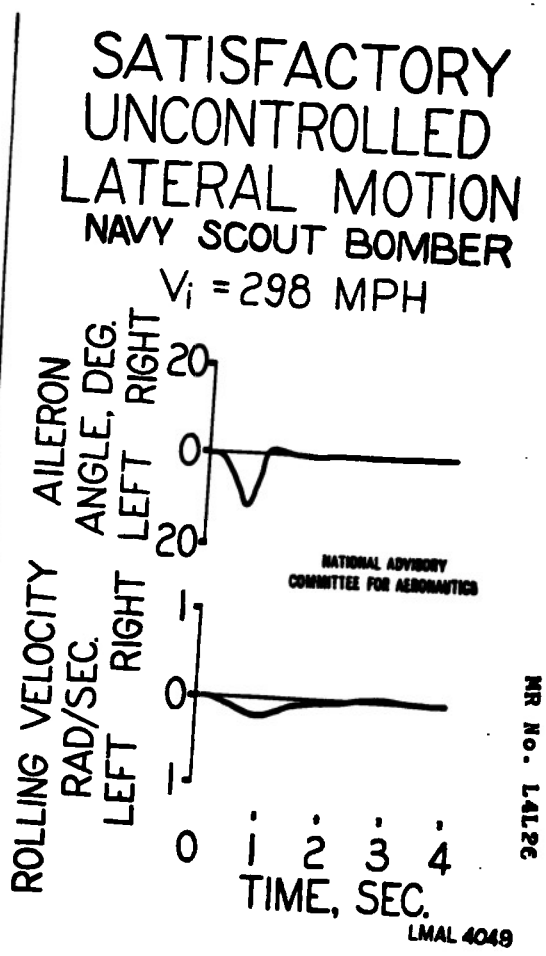
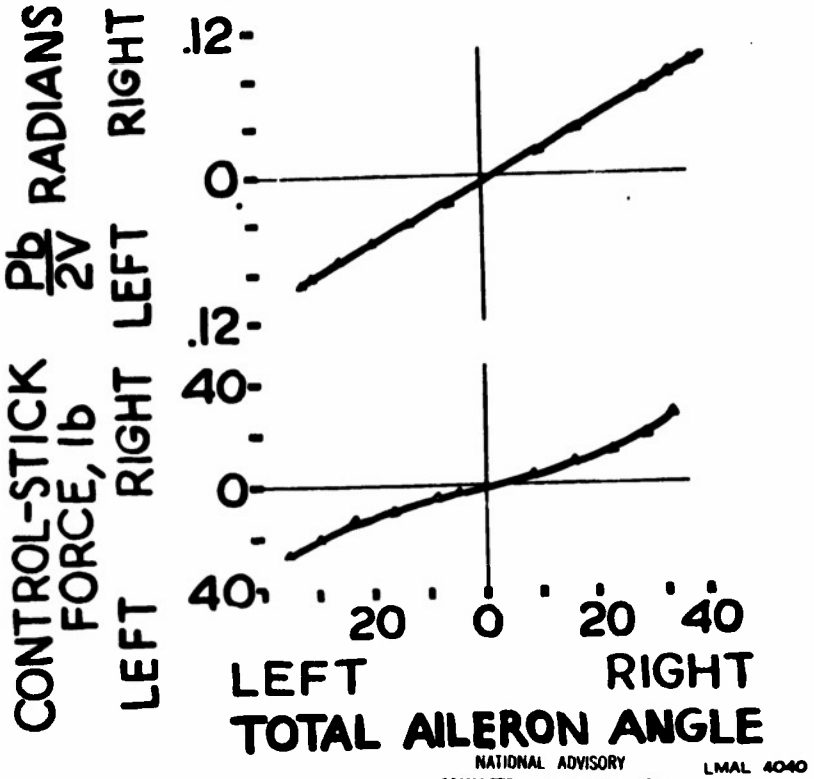


Figure 17.

L-706

SATISFACTORY AILERON FORCE CHACTERISTICS

FIGHTER AIRPLANE (EXPERIMENTAL AILERON) CLEAN CONDITION V_i = 201 MPH



NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

LMAL 4040

Figure 18.

MR No. L4L26

UNSATISFACTORY AILERON FORCE CHARACTERISTICS

FIGHTER AIRPLANE (CLEAN CONDITION) V_i = 210 MPH

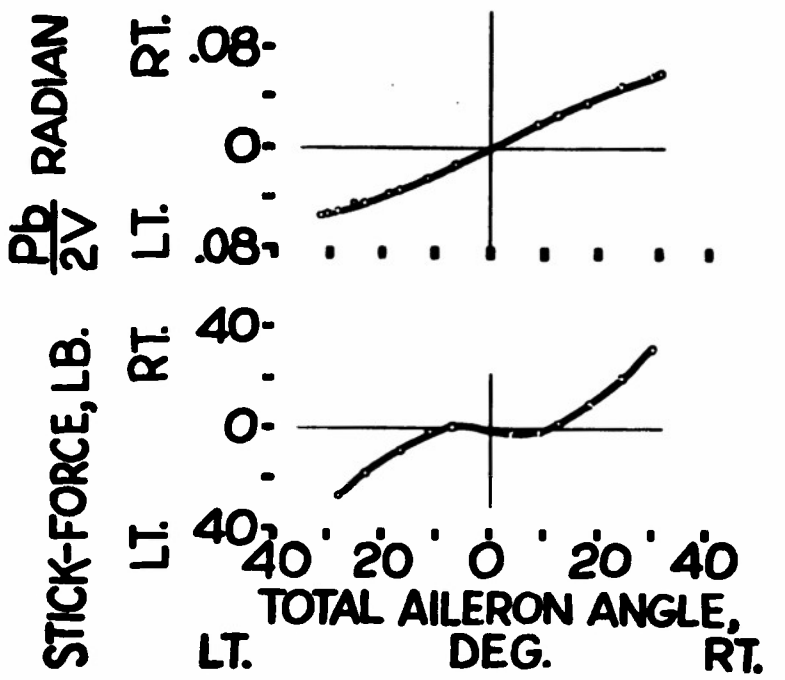


Figure 19. NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS LMAL 4035

AILERON EFFECTIVENESS OF VARIOUS FIGHTER AIRPLANES WITH 50 LB. STICK FORCE

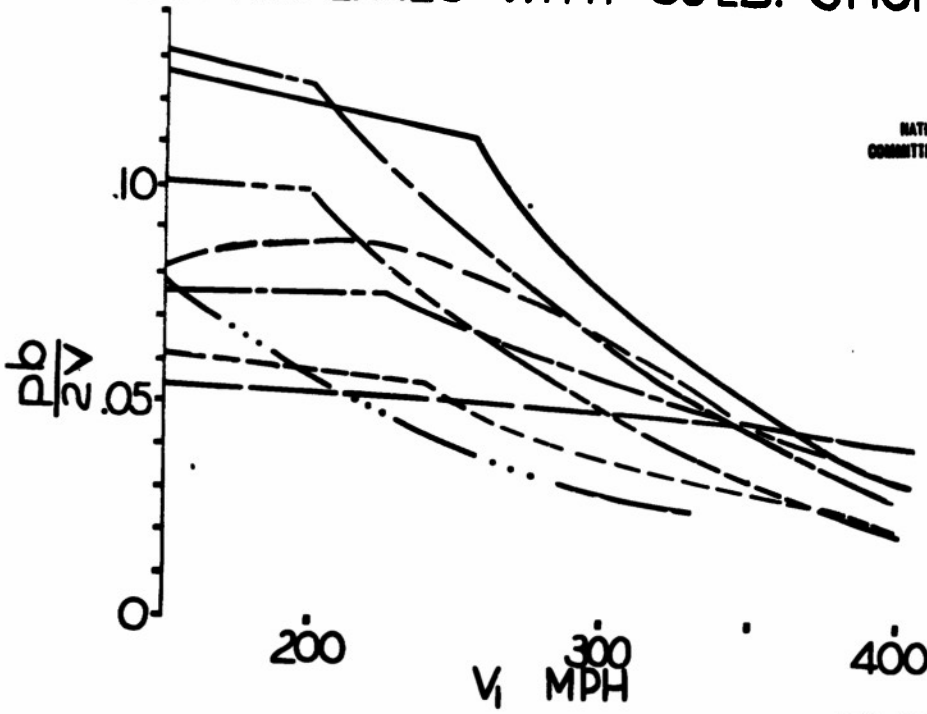


Figure 20

NR No. L4126

UNSATISFACTORY DIRECTIONAL TRIM CHARACTERISTICS

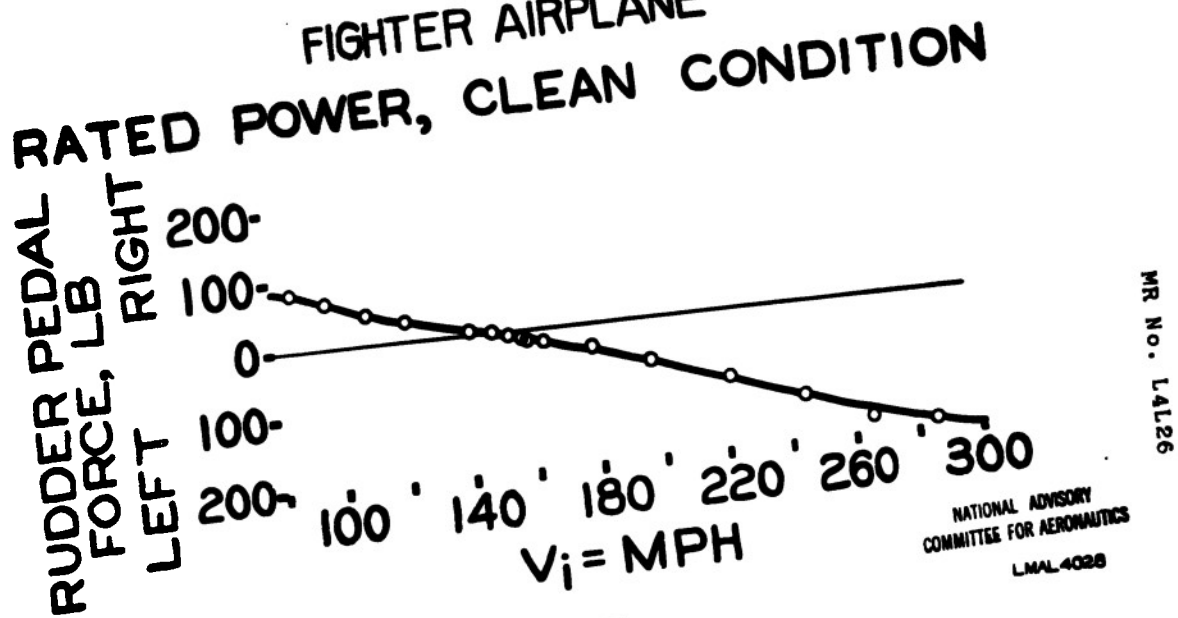


Figure 21.

L-706

SATISFACTORY DIRECTIONAL TRIM CHARACTERISTICS

ATTACK BOMBER
RATED POWER, CLEAN CONDITION

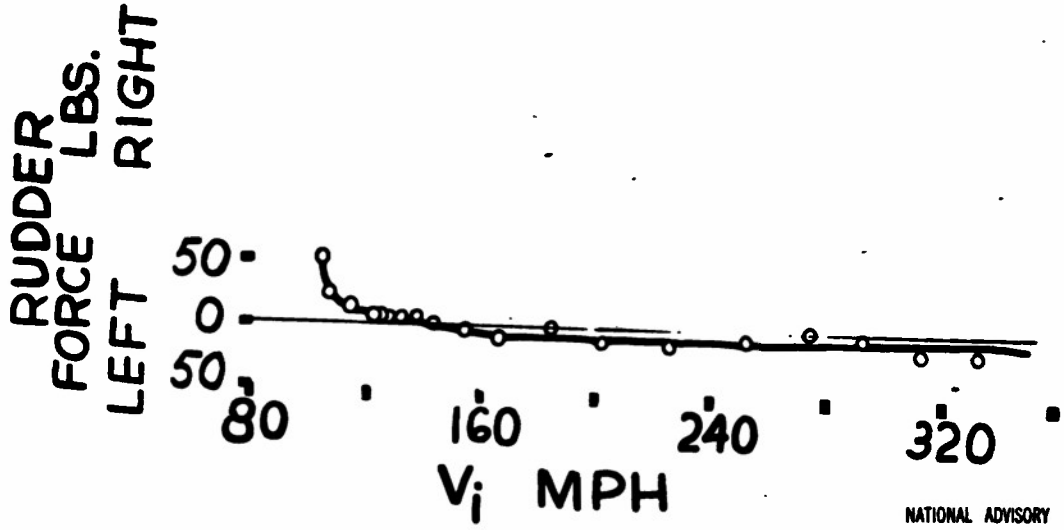


Figure 22.

NACA MR No. L4L26

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

LMAL 4035

EFFECT OF LATERAL C.G. SHIFT ON RUDDER DEFLECTION REQUIRED FOR TRIM

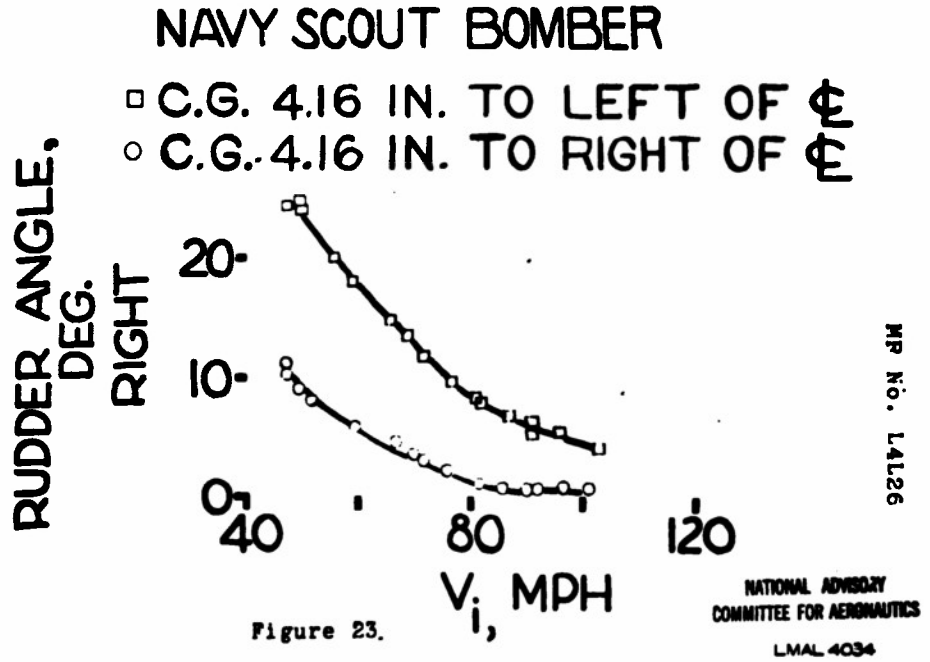
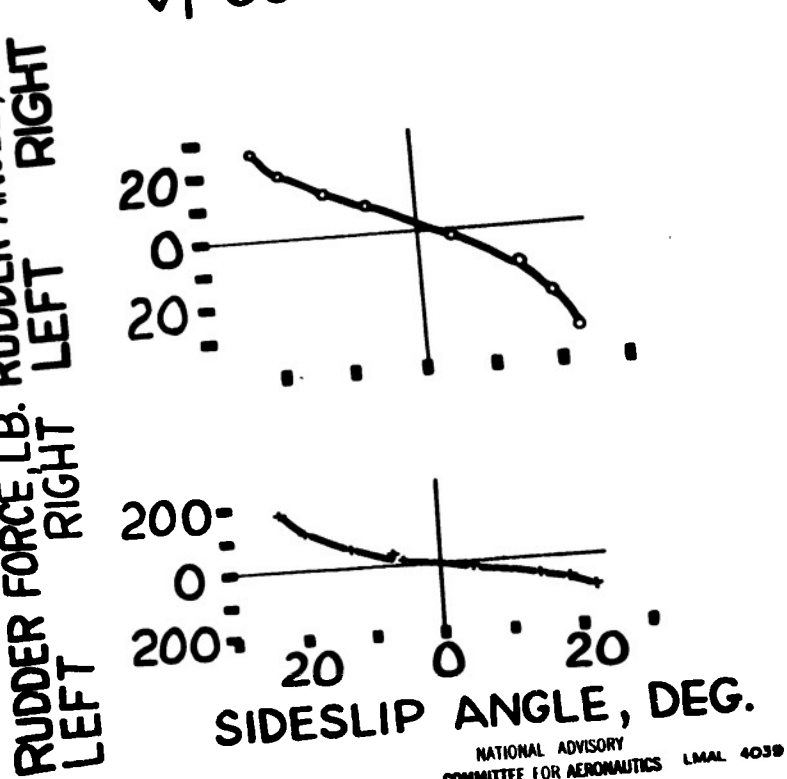


Figure 23.

L-706

SATISFACTORY DIRECTIONAL STABILITY CHARACTERISTICS

FIGHTER AIRPLANE CLIMBING CONDITION V_i=90 MPH

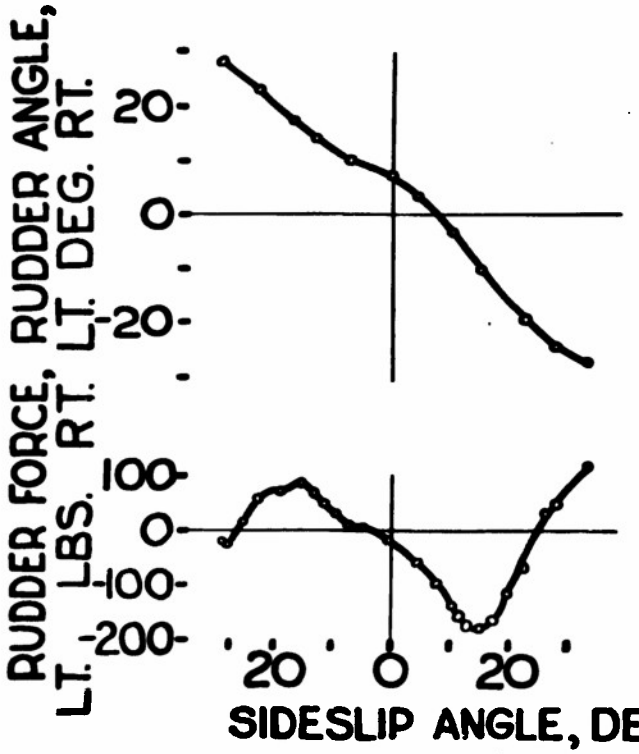


NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS LMAL 4039

Figure 24.

UNSATISFACTORY RUDDER FREE STABILITY

NAVY SCOUT BOMBER, CLIMBING CONDITION, V_i = 120 MPH

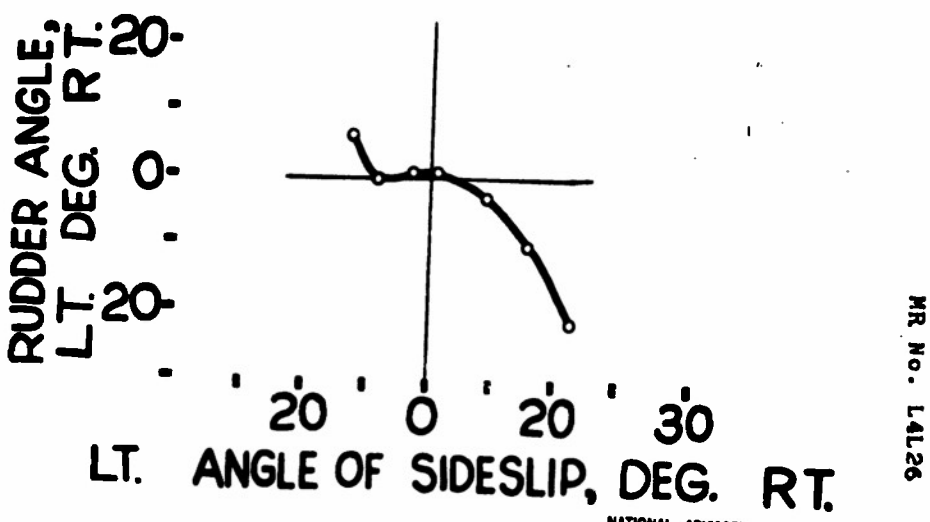


NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS LMAL 4037

Figure 25.

UNSATISFACTORY RUDDER FIXED STABILITY

NAVY TORPEDO BOMBER, GLIDING CONDITION V_i = 92 MPH



MR No. L4L26

Figure 26.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS LMAL 4058

L-706

SATISFACTORY STICK FIXED AND STICK FREE DIHEDRAL EFFECT

FIGHTER AIRPLANE CLIMBING CONDITION, 252 MPH

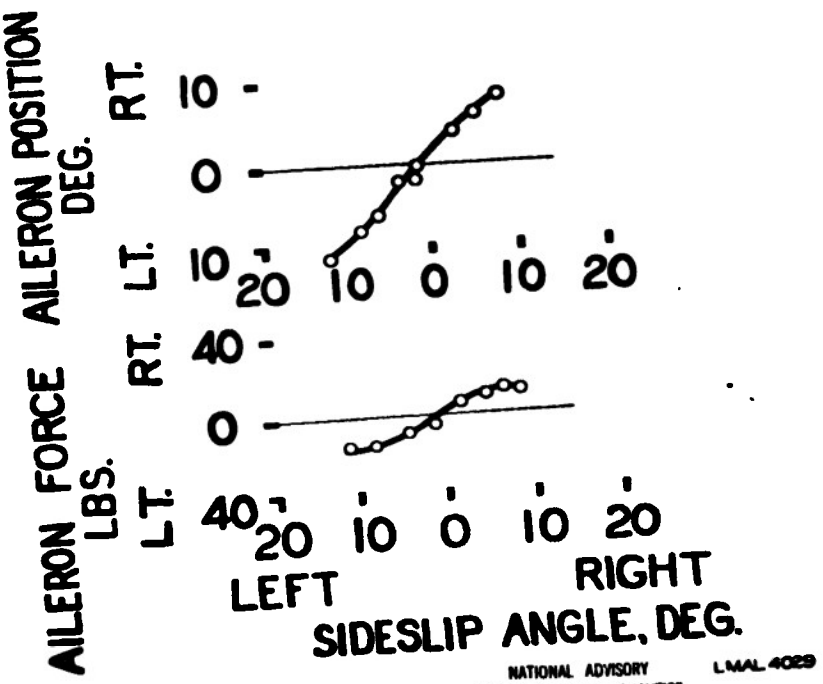
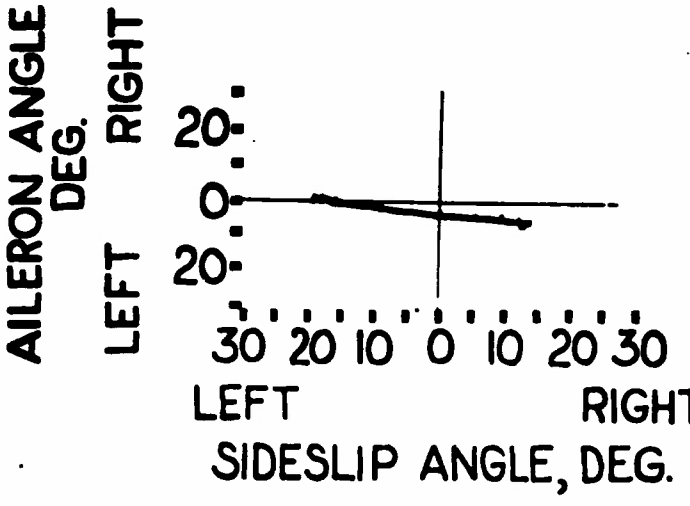


Figure 27.

L-706

UNSATISFACTORY STICK FIXED DIHEDRAL EFFECT

FIGHTER AIRPLANE
LANDING CONDITION
V_i = 120 MPH



NR No. L4L26

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
LMAL 4030

Figure 28.

MR No. L4L26

UNSATISFACTORY STICK FREE DIHEDRAL EFFECT

FIGHTER AIRPLANE
CLEAN CONDITION, RATED POWER
V_i=110 MPH

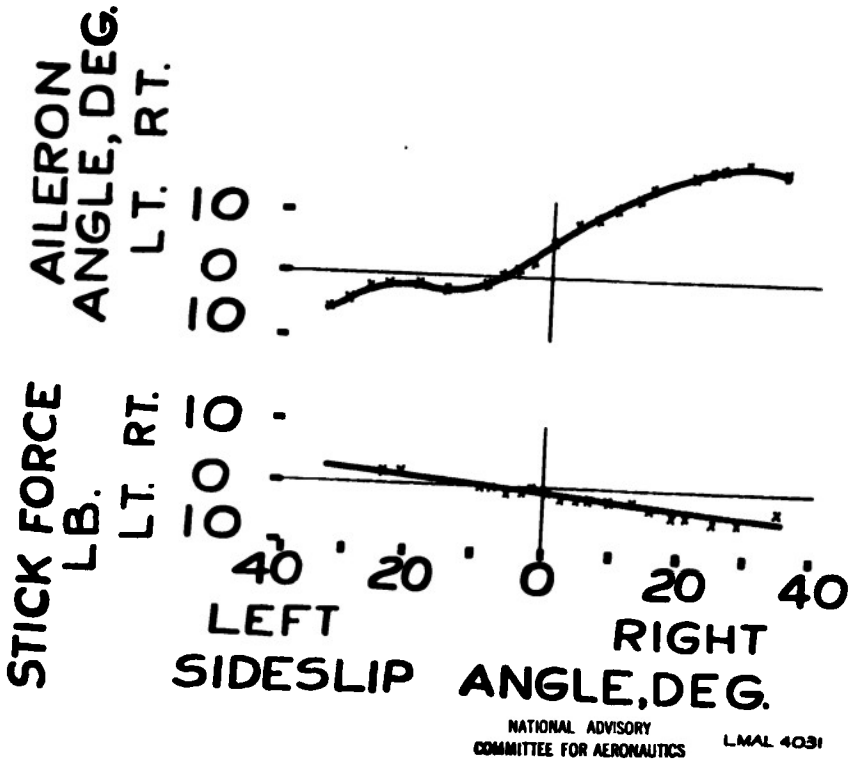


Figure 29.

L-706

SATISFACTORY PITCHING MOMENT DUE TO SIDESLIP

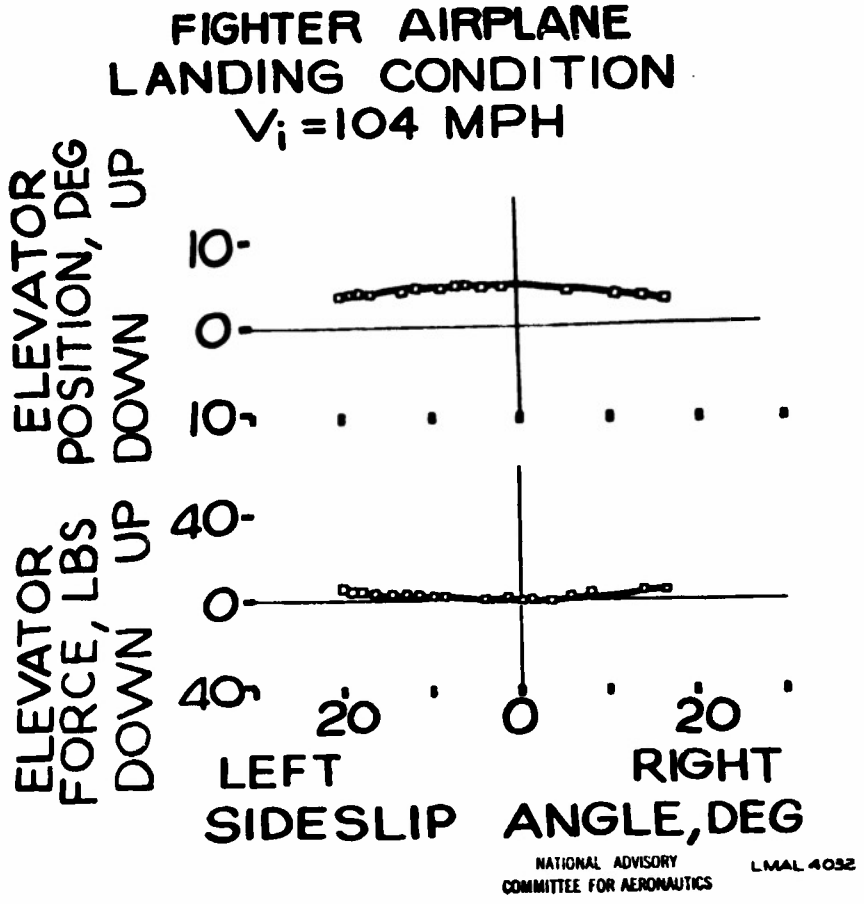
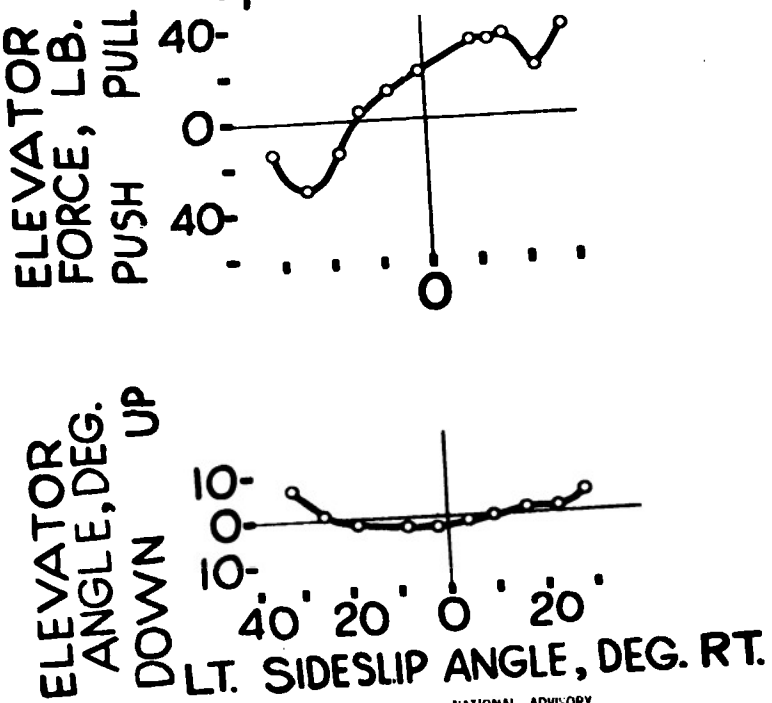


Figure 30.

L-706

UNSATISFACTORY PITCHING MOMENT DUE TO SIDESLIP

NAVY TORPEDO BOMBER
CLEAN, RATED POWER
V_i = 95 MPH



NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS LMAL 4036

Figure 31.

AUTHOR(S)

DIVISION: Aerodynamics (2)
SECTION: Stability and Control (1)
CROSS REFERENCES: Airplanes - Control characteristics (08393); Airplanes - Stability (08487); Airplanes, Bomber - Performance charts (08517)

ORIG. AGENCY NUMBER
NR L4L26
REVISION

AMER. TITLE: Charts showing stability and control characteristics of airplanes in flight

OVER

FOREIGN TITLE:

ORIGINATING AGENCY: National Advisory Committee for Aeronautics, Washington, D. C.

TRANSLATION:

COUNTRY	LANGUAGE	FOREIGN CLASS	U. S. CLASS.	DATE	PAGES	ILLUS.	FEATURES
U.S.	Eng.		Unclass.	Dec '44	32		graphs

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DATED 31 DECEMBER 1947.

(2) p 1/1, p 1/3/3, p 1/3/4

(23) Inflight

* Aerodynamic stability
* Fighter aircraft
* Patrol aircraft